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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/672,786

09/26/2003

Richard John Defouw

2003-080-DSK

9670

7590

05/12/2006

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EXAMINER

TSAI, SHENG JEN

ART UNIT

PAPER NUMBER

2186

DATE MAILED: 05/12/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No.	Applicant(s)	
	10/672,786	DEFOUW ET AL.	
	Examiner	Art Unit	
	Sheng-Jen Tsai	2186	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 27 April 2006.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-39 is/are pending in the application.
- 4a) Of the above claim(s) 13, 14 and 27-39 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-12 and 15-26 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

### **DETAILED ACTION**

1. This Office Action is taken in response to Applicants' Amendment and Remarks filed on April 27, 2006 regarding application 10/672,786 filed on September 26, 2003.

2. Claims 1, 15 and 26 have been amended.

Claims 13-14, and 27-39 have been cancelled.

Claims 1-12 and 15-26 are pending in the application under consideration.

3. ***Response to Remarks***

Applicants' remarks have been fully and carefully considered with Examiner's responses detailed below.

**As to amendment for claim 1, 15 and 26**

Each of independent claims 1, 15 and 26 has been amended with the additional limitations recited originally in claims 13-14 which were indicated in the previous Office Action as would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

As such, independent claims 1, 15 and 26, and those claims dependent from them, become allowable.

***Double Patenting***

4. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225

USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

5. Claims 1-12 and 15-26 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-20 of copending Application No. **10/672,134**, as shown in the following table. Although not all of the conflicting claims are exactly identical, they are extremely similar and are not patentably distinct from each other as explained in the "explanation" column of the table below:

<b>10/672,134</b>	<b>10/672,786</b>
1. A method for managing data in a memory device having a plurality of blocks, comprising the steps of: maintaining a count of how many times each block has been modified since a previous wear-leveling event; and initiating a current wear-leveling event when the count for a given block exceeds a predetermined threshold.	1. A method for managing data in a memory device having a plurality of blocks, comprising the steps of: maintaining a first vector having block entries sorted in order of number of overall block modifications for each block of the plurality of blocks; maintaining a second vector having block entries sorted in order of number of block modifications since a previous wear-leveling event; and using the first vector and the second vector to determine which of the plurality of blocks should have its

	<p>associated data relocated to another block; wherein the using step comprises the steps of: (i) determining which of a first given block associated with an entry in the first vector and a second given block associated with an entry in the second vector is more physically worn; (ii) determining which of the first given block and the second given block is more active; (iii) if either one of the first given block and the second given block are both the more physically worn block and the more active block, updating a swap table to indicate that contents of the first given block should be swapped with contents of the second given block; (iv) repeating steps (i) - (iii) for each block entry in at least the first vector; (v) re-sorting the second vector such that the blocks associated with the block entries contained therein are sorted in order of number of block modifications since a previous wear-leveling event; (vi) repeating steps (i) - (iv) for the re-sorted second vector; and (vii) swapping blocks according to the swap table; and wherein in step (v) the second vector is sorted in reverse order from the order in which it was originally sorted in and, in addition, the first vector is also re-sorted in reverse order from the order in which it was originally sorted in.</p>
2. The method of Claim 1, wherein the current wear-leveling event comprises the step of copying data contained in at least one block having higher usage to at least one block having lower usage.	2. The method of Claim 1, wherein the first vector is sorted in descending order of overall block usage and the second vector is sorted in ascending order of block usage since the previous wear level event.
3. The method of Claim 2, further comprising the step of copying data contained in at least one block having lower usage to at least one block having higher usage when the count exceeds the predetermined threshold.	3. The method of Claim 1, wherein the first vector is sorted in ascending order of overall block usage and the second vector is sorted in descending order of block usage since the previous wear level event.
4. The method of Claim 1 wherein the count is maintained in a block descriptor for each block, and pointers to each block descriptor are maintained in two vectors.	4. The method of Claim 1, wherein the block entries for the first and second vectors each comprise a pointer to a block descriptor for each of the plurality of blocks.
5. The method of Claim 4, wherein a first of the two vectors is sorted in order of how many times each block has been erased in total.	5. The method of Claim 4, wherein each said block descriptor maintains a modification count for its respective block.
6. The method of Claim 5, wherein a second of the two vectors is sorted in order of how many times each block has been erased since a previous wear-leveling event.	6. The method of Claim 5, wherein the modification count comprises a count of total overall modifications (n count) for its respective block and total modifications since a previous wear-leveling event (An count) for the respective block.
7. The method of Claim 6, wherein the first vector is sorted in descending order and the second vector is sorted	7. The method of Claim 6, wherein the n count for a first given block in the first vector is compared to the n count for a

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in ascending order.	second given block in the second vector to determine which of the first and second blocks is more physically worn, and wherein the An count for the first given block in the first vector is compared to the An count for the second given block in the second vector to determine which of the first and second blocks is more active, and further comprising the step of swapping contents of the first given block with the second given block if either of the first given block and second given block are both the more physically worn block and the more active block.
8. The method of Claim 6, wherein the first vector is sorted in ascending order and the second vector is sorted in descending order.	8. The method of Claim 1, wherein the using step comprises the step of copying data contained in a block having higher usage to a block having lower usage.
9. The method of Claim 1, further comprising the step of maintaining a second count of how many times each block has been erased in total.	9. The method of Claim 8, further comprising the step of copying data contained in a block having lower usage to a block having higher usage.
10. The method of Claim 9, wherein the memory device comprises a block header for each of the plurality of blocks, and wherein the second count for each block is maintained in the block header for each respective block.	10. The method of Claim 1 wherein the block modifications are at least one of erasing blocks and writing blocks.
11. The method of Claim 2, wherein the higher usage is higher overall erase usage and the lower usage is lower erase usage since the last wear-leveling event.	11. The method of Claim 1, wherein the step of using the first vector and the second vector comprises the steps of: determining which of a first given block associated with an entry in the first vector and a second given block associated with an entry in the second vector is more physically worn; determining which of the first given block and the second given block is more active; and swapping contents of the first given block with contents of the second given block if either of the first given block and the second given block are both the more physically worn block and the more active block.
12. The method of Claim 3, wherein the higher usage is higher overall erase usage and the lower usage is lower erase usage since the last wear-leveling event.	12. The method of Claim 11, wherein the more physically worn determining step and the more active determining step are repeated for a plurality of blocks associated with entries in the first and second vectors, and wherein the swapping step is deferred until each of the plurality of blocks associated with each of the first and second vectors have been processed.
13. The method of Claim 1 wherein the count of how many times each block has been modified since a previous wear-leveling event is a count of how many times each block has been erased since a previous wear-leveling event.	15. A system for managing data in a memory device having a plurality of blocks, comprising: a first vector having block entries sorted in order of number of overall block modifications for each block of the plurality of blocks; a second vector having block entries sorted in order of

	<p>number of block modifications since a previous wear-leveling event; and means for using the first vector and the second vector to determine which of the plurality of blocks should have its associated data relocated to another block; wherein the using step comprises the steps of: (i) determining which of a first given block associated with an entry in the first vector and a second given block associated with an entry in the second vector is more physically worn; (ii) determining which of the first given block and the second given block is more active; (iii) if either one of the first given block and the second given block are both the more physically worn block and the more active block, updating a swap table to indicate that contents of the first given block should be swapped with contents of the second given block; (iv) repeating steps (i) - (iii) for each block entry in at least the first vector; (v) re-sorting the second vector such that the blocks associated with the block entries contained therein are sorted in order of number of block modifications since a previous wear-leveling event; (vi) repeating steps (i) - (iv) for the re-sorted second vector; and (vii) swapping blocks according to the swap table; and wherein in step (v) the second vector is sorted in reverse order from the order in which it was originally sorted in and, in addition, the first vector is also re-sorted in reverse order from the order in which it was originally sorted in.</p>
<p>14. A system for managing data in a memory device having a plurality of blocks, comprising: means for maintaining a count of how many times each block has been modified since a previous wear-leveling event; and means for initiating a current wear-leveling event when the count for a given block exceeds a predetermined threshold.</p>	<p>16. The system of Claim 15, wherein the first vector is sorted in descending order of overall block usage and the second vector is sorted in ascending order of block usage since the previous wear-leveling event.</p>
<p>15. A method for managing data in a memory device having a plurality of physical blocks, comprising the steps of: relocating data from an infrequently used physical block to a frequently used physical block; and relocating data from a frequently used physical block to an infrequently used physical block.</p>	<p>17. The system of Claim 15, wherein the first vector is sorted in ascending order of overall block usage and the second vector is sorted in descending order of block usage since the previous wear-leveling event.</p>
<p>16. The method of Claim 15, wherein the step of relocating data from an infrequently used physical block to a frequently used physical block is initiated when any of the plurality of</p>	<p>18. The system of Claim 15, wherein the first and second vectors each comprise a pointer to a block descriptor for each of the plurality of blocks.</p>

blocks has been modified more than a predetermined number of times.	
17. The method of Claim 15, wherein the step of relocating data from an infrequently used physical block to a frequently used physical block is initiated when any of the plurality of blocks has been erased more than a predetermined number of times.	19. The system of Claim 18, wherein each said block descriptor maintains a modification count for each of the plurality of blocks.
18. A system for managing data in a memory device having a plurality of physical blocks, comprising: means for relocating data from an infrequently used physical block to a frequently used physical block; and means for relocating data from a frequently used physical block to an infrequently used physical block.	20. The system of Claim 19, wherein the modification count comprises a count of total overall modifications (n count) for its respective block and total modifications since a previous wear-leveling event (An count) for the respective block.
19. The system of Claim 18, wherein the means for relocating data from an infrequently used physical block to a frequently used physical block is initiated when any of the plurality of blocks has been modified more than a predetermined number of times.	21. The system of Claim 20, wherein the n count for a first given block in the first vector is compared to the n count for a second given block in the second vector to determine which of the first and second blocks is more physically worn, and wherein the An count for the first given block in the first vector is compared to the An count for the second given block in the second vector to determine which of the first and second blocks is more active, and further comprising the step of swapping contents of the first given block with the second given block if either of the first given block and second given block are both the more physically worn block and the more active block.
20. The system of Claim 18, wherein the means for relocating data from an infrequently used physical block to a frequently used physical block is initiated when any of the plurality of blocks has been erased more than a predetermined number of times.	22. The system of Claim 15, further comprising means for copying data contained in a block having higher usage to a block having lower usage.
	23. The system of Claim 22, further comprising means for copying data contained in a block having lower usage to a block having higher usage.
	24. The system of Claim 15 wherein the block modifications are at least one of erasing blocks and writing blocks.
	25. The system of Claim 15, wherein the means for using comprises: first means for determining which of a first given block associated with an entry in the first vector and a second given block associated with an entry in the second vector is more physically worn; second means for determining which of the first given block and the second given block is more active; and means for swapping contents of the



	first given block with contents of the second given block if either of the first given block and the second given block are both the more physically worn block and the more active block.
	26. A data storage subsystem comprising a memory controller, system memory and a plurality of flash devices, each flash device organized as a plurality of blocks, wherein the memory controller operates to perform the steps of: maintaining a first vector having block entries sorted in order of number of overall block modifications for each block of the plurality of blocks; maintaining a second vector having block entries sorted in order of number of block modifications since a previous wear-leveling event; using the first vector and the second vector to determine which of the plurality of blocks should have its data located to another block; wherein the using step comprises the steps of: (i) determining which of a first given block associated with an entry in the first vector and a second given block associated with an entry in the second vector is more physically worn; (ii) determining which of the first given block and the second given block is more active; (iii) if either one of the first given block and the second given block are both the more physically worn block and the more active block, updating a swap table to indicate that contents of the first given block should be swapped with contents of the second given block; (iv) repeating steps (i) - (iii) for each block entry in at least the first vector; (v) re-sorting the second vector such that the blocks associated with the block entries contained therein are sorted in order of number of block modifications since a previous wear-leveling event; (vi) repeating steps (i) - (iv) for the re-sorted second vector; and (vii) swapping blocks according to the swap table; and wherein in step (v) the second vector is sorted in reverse order from the order in which it was originally sorted in and, in addition, the first vector is also re-sorted in reverse order from the order in which it was originally sorted in.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

***Allowable Subject Matter***

6. Claims 1-12 and 15-26 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-20 of copending Application No. **10/672,134**, but would be allowable if able to overcome the provisional obviousness-type double patenting rejection.

7. ***Related Prior Art of Record***

The following list of prior art is considered to be pertinent to applicant's invention, but not relied upon for claim analysis conducted above.

- Bruce et al. (US 6,000,006), "Unified re-map and cache-index table with dual write-counters for wear-leveling of non-volatile flash RAM mass storage."
- Chang et al., (US 6,973,531), "Tracking the Most Frequently Erased Blocks in Non-Volatile Memory Systems."
- Chang et al., (US 6,831,865), "Maintaining Erase Counts in Non-Volatile Storage Systems."
- Chen et al., (US 6,944,063), "Non-Volatile Semiconductor Memory with Large Erase Blocks Storing Cycle Counts."
- Lofgren et al., (US 6,230,233), "Wear Leveling Techniques for Flash EEPROM Systems."

***Conclusion***

8. Claims 1-12 and 15-26 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-20 of

compending Application No. **10/672,134**, but would be allowable if able to overcome the provisional obviousness-type double patenting rejection.

**9. THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

**10.** Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sheng-Jen Tsai whose telephone number is 571-272-4244. The examiner can normally be reached on 8:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Kim can be reached on 571-272-4182. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Sheng-Jen Tsai  
Examiner  
Art Unit 2186

May 7, 2005

  
**PIERRE BATAILLE**  
**PRIMARY EXAMINER**  
5/8/06